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Endoparasites Inventory and Prevalence of *Scomberomorus commerson* in Sumatera Province, Indonesia

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ABSTRACT

This study was conducted from August to September 2021 and aimed to detect parasites and to determine their prevalence in the digestive tract of mackerel (*Scomberomorus commerson*) in Belawan, North Sumatra Province. Fish samples were randomly taken from the study site and classified according to length and weight before being dissected at the Laboratory of the Technical Implementation Unit for the Application of Quality of Fishery Products (UPTPMPH), Medan. The mackerel's gastrointestinal system was collected and observed under a microscope to detect the presence of parasites. The result of this study showed that four genera of parasites were identified, which infected the organs of mackerel in the intestines and stomach. The prevalence of *Rhadinorhynchus* sp. was found to be 40% in the intestine and 6.66% in the stomach. In contrast, *Anisakis* sp. and *Camallanus* sp. were only found in the intestine with prevalence rates of 6.66 and 36.66%, respectively. *Lecithocladium* sp. was found in the stomach with a prevalence rate of 16.66%. Moreover, the highest prevalence was observed in the intestine and stomach for *Rhadinorhynchus* sp. This parasite often attacks most fish, while *Anisakis* sp., *Camallanus* sp., and *Lecithocladium* sp. were found exclusively in different organs.

INTRODUCTION

The mackerel is a marine fish from the Scombridae family that is widely consumed by the public, particularly in Indonesia. However, the fish often harbors various parasites diseases, such as those found in the stomach and intestine **(Yusni & Rambe, 2019)**. The occurrence of these diseases is often attributed to unfavorable environmental conditions **(Hidayat, 2018; Alvin *et al*., 2019)**. Understanding fish diseases involves considering the complex interactions between stressors, virulent pathogens, and suboptimal environmental quality **(Sarjito *et al*., 2013; Nofasari *et al*., 2019)**. Parasites are classified into two different groups based on the organs infected, namely endoparasites and ectoparasites. Ectoparasites are parasites that attack the external parts of the fish body or parts with a direct contact with the outside environment **(Linayati, 2018)**. On the other hand, endoparasites attack the internal parts

of the fish, such as the digestive tract, blood circulation, or other internal organs **(Sarjito *et al*., 2013; Syukran *et al*., 2017)**. Previous studies reported the detection of parasites in the mackerel fish, with three out of five examined samples found to be infected at the Lampulo TPI, Banda Aceh City **(Harahap *et al*., 2018)**. Nematodes are the most common group of parasites that infect fish, primarily due to their feeding habits and habitat preferences **(Hardi, 2015)**.

Therefore, it is likely that marine fish are infected with nematodes **(Lilimantik *et al*., 2015)**. These parasites do not cause mortality but can decrease fish quality and endanger the sustainability of fish populations **(Utami, 2014)**.

The development of endoparasites in fish bodies is influenced by several factors in the environment, including temperature and chemical content of waters **(Hassan, 2008)**. In addition, the presence of invertebrate organisms living around floating net cages is also a factor affecting the spread of endoparasites in fish **(Amrina *et al*., 2014; Arai & Smith., 2016; Arizona *et al*., 2020)**. This is because these organisms can act as intermediate hosts of several endoparasite species **(Ruckert *et al*., 2009)**. One of the losses caused by parasitic attacks is the decrease in fish body weight which is closely related to the presence of endoparasites in the digestive tract of fish so that fish experience a decrease in appetite. The existence of endoparasites can cause death in the host population and the consequences can cause huge losses for the fishing industry **(Muttaqin, 2013; Hadiroseyani *et al*., 2006)**. Endoparasite infection can cause economic adverse impacts, namely fish weight loss, consumer rejection due to pathological changes in the host, decreased fish fecundity and decreased number of hatching fish and larvae **(Anshary, 2008)**. Endoparasites of *Rhadinorhyncus* sp. are often found infecting fish from the Scombridae family, and in this case, it was the tuna fish (*Euthynnus* sp.) **(Uliya & Yusni., 2020)**. In addition to a very high number of infections, this endoparasite is zoonotic (a disease in fish that can be transmitted to humans), hence it can affect the health of people who consume it **(Hibur *et al*., 2016)**. The level of intensity and prevalence of Endoparasites in flying fish determine the level infection and density of invading parasites fish health **(Amrina *et al*., 2014; Arai & Smith, 2016; Arizona *et al*., 2020)**.

There is limited information available on the occurrence and identification of endoparasites in the Indonesian fish, particularly the mackerel. Since many Indonesians use mackerel as processed fish, more information on processing and knowledge about diseases of this fish are required. Therefore, this study was conducted to provide guidelines on the appropriate handling of endoparasites found in the mackerel fish.

MATERIALS AND METHODS

Time and place of the study

This study was conducted from August to September 2021, with samples of mackerel taken from traditional fishermen who made fish landings at the Belawan Sea Fishing Port, North Sumatra Province. The identification and prevalence of

endoparasites were carried out at the Disease Laboratory, Faculty of Agriculture, University of North Sumatera.

Study procedure

This study was conducted by direct sampling at the study site using a random sampling technique. Fish samples were taken randomly from three tangtang in Belawan, North Sumatra Province, resulting in a total of 10 fish. The fish samples were classified based on length, with two categories of 27- 33 and 34- 40cm. The procedure was repeated three times with a total sample of 30 fish. Fish samples were weighed and then dissected using a sterilized blade following the procedures described in the Indonesian standard (SNI 2332.6: 2015) **(Buchman., 2001)**. The digestive tracts, particularly the intestine and stomach, were carefully scraped using a spatula and kept separately in a Petri dish containing 0.85% NaCl solution. The samples were then placed on a slide, dripped with physiological NaCl solution, and covered with a coverslip for observation under a microscope at 40x magnification. In addition, the walls of the digestive organs were examined to detect the presence of parasitic worms attached to the contents of the stomach, intestines, and organs.

Data analysis

The study data were presented in tables and figures and were descriptively analyzed based on the detection results of *S. commerson*. The prevalence (%) of infection was calculated based on the method of **Kabata (1985)** and **Hakim *et al*. (2019)**, as the number of fish samples divided by the number of infected fish were multiplied by 100. The supporting parameters in this study were fish size, which included length and weight, and type of intestinal and stomach organs. These supporting parameters were used as additional data for the main parameters. The infection categories were determined based on prevalence using the reference of **Syukran *et al*. (2017)**, as shown in Table (1).

Table 1. Infection category of parasitic worms based on prevalence

No	Prevalence (%)	Infection category	Information
1	<0.01	Almost never	Never
2	<0,.1-0.01	Very rarely	Very Rarely
3	<1-0.1	Rarely	Rarely
4	1-9	Sometimes	Sometimes
5	10-29	Often	Often
6	30-49	Generally	Generally
7	50-69	Very often	Very often
8	70-89	Usually	Moderate
9	90-98	Almost always	Severe
10	99-100	Always	Very severe

RESULTS

Identification of endoparasites species

Table (2) shows the results of the parasites detection in the gastrointestinal system of *S. commerson* at the Belawan Marine Fisheries Port, North Sumatra. Four parasite types were identified, with two belonging to the phylum Nemathelminthes, namely *Camallanus* sp. and *Anisakis* sp. Meanwhile, the other two species, *Rhadinorhynchus*, and *Lecithocladium* belong to the phylum Acanthocephala, known as spiny worms, and Platyhelminthes, known as flatworms, respectively.

Table 2. Identification of parasites invading the digestive tract of mackerel

Phylum	Class	Ordo	Family	Genus	Total (Ind)
Platyhelminthes	Trematoda	Plagiorchiida	Hemiuridae	*Lecithocladium*	6
Nemathelminthes	Nematoda	Ascaridia	Anisakidae	*Anisakis*	2
Acantho cephala	Palaeacan thocephala	Echino Rhynchida	Rhadino Rhynchidae	*Rhadinorhynch us*	42
Nemathelminthes	Nematoda	Camallanoi dea	Camallanida e	*Camallanus*	36

The types of parasites found can be seen in Figs. (1- 4). *Lecithocladium* sp. was found to infect the digestive tract of the mackerel. It is a digenean worm with two suckers, namely the anterior sucker located at the anterior part of the body and the ventral sucker at the anterior third of the ventral surface. Fig. (1) shows the two distinct characteristics of *Lechithocladium* sp., with some specimens being long and slender, with a flat dorsoventral and a smooth prickly cuticle, while others were leaf-shaped.

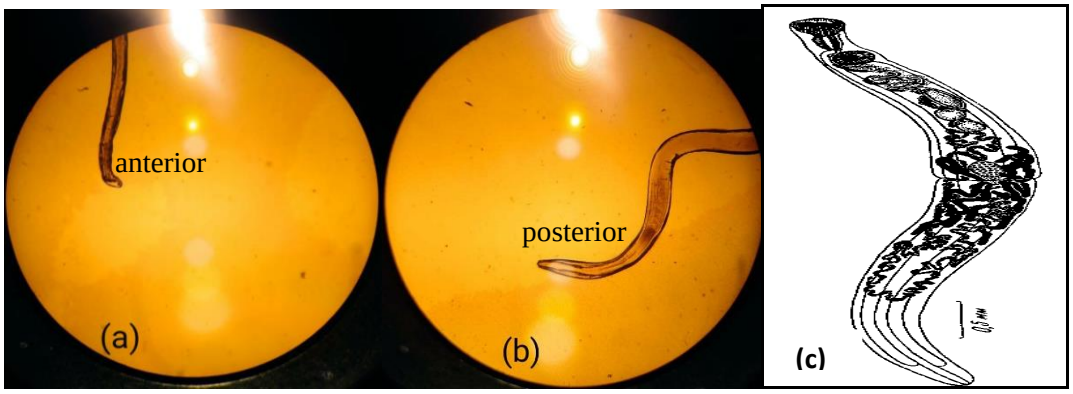

Fig. 1. *Lecithocladium* sp. (**a.** Anterior, **b.** Posterior) **c.** magnification of 40x **(Source: Yamaguti., 1953)**.

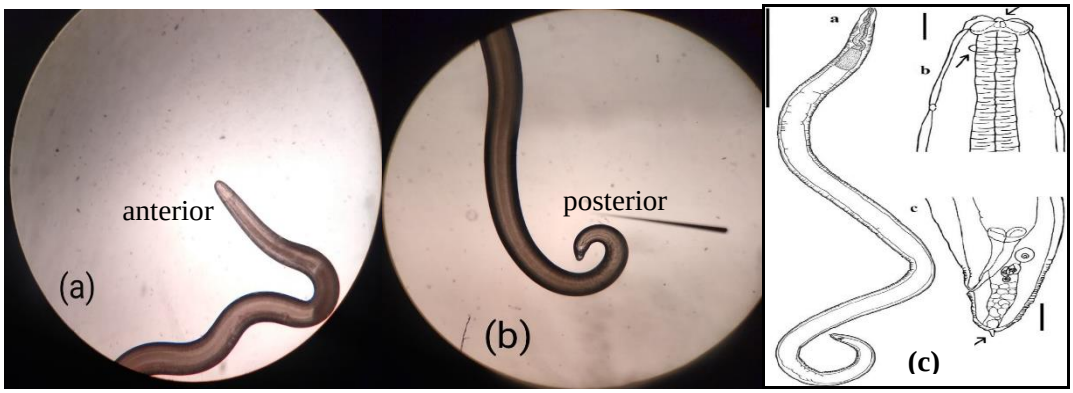

Fig. 2. *Anisakis* sp. (**a.** Anterior, **b**. Posterior) **(c)** magnification of 40x **(Source: Alves *et al*., 2019)**

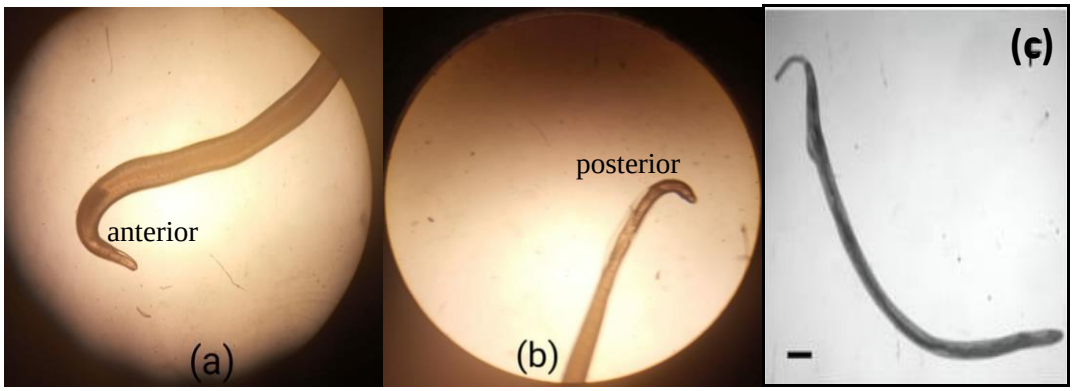

Fig. 3. *Rhadinorhynchus* sp. (**a.** Anterior, **b.** Posterior) **c.** magnification of 40x **(Source: Shih *et al*., 2010)**

Anisakis sp. was also discovered during the investigation, although it was the least prevalent among the identified parasites. This parasite is characterized by its white color and a small, circular body form. The white larva of *Anisakis* sp. has a tiny smooth body with dangling teeth in the front region. Fig. (2) provides a visual depiction of the elongated ventriculus of the parasite, resembling black dots.

Fig. (3) shows *Rhadinorhynchus* sp., a commonly found parasite that lives on hosts and exhibits zoonotic potential, indicating its ability spread from animals to humans. The Scombridae family, particularly the Scombridae in the Atlantic, serves as a peculiar host for this parasite. *Rhadinorhynchus* sp. is classified as a typical host-specific parasite, meaning that it manifests in the same area as the host.

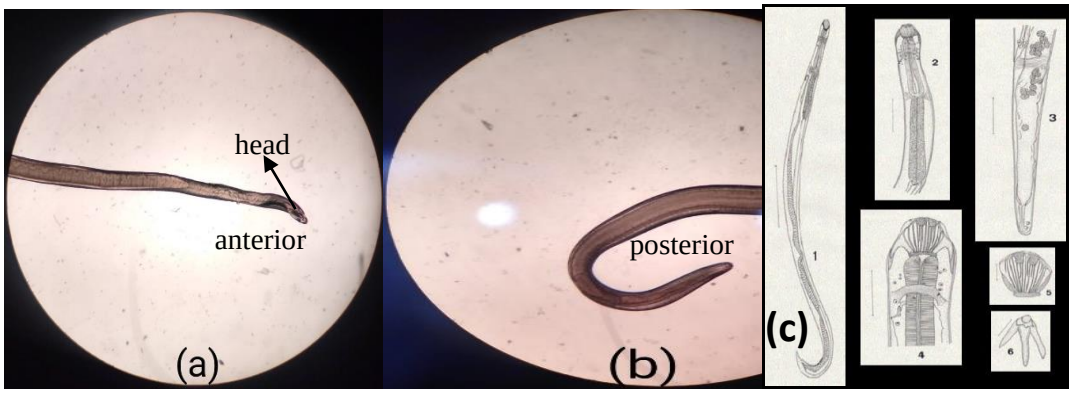

Fig. 4. *Camallanus* sp. (**a.** Anterior, **b.** Posterior) **c.** magnification of 40x **(Source: Martins *et al*., 2007)**

Camallanus sp. is a nematode parasite characterized by its elongated cylindrical body size. The body is covered by a thin layer of cuticle that extends from the anterior end to the tip. Fig. (4) shows the appearance of different types of *Camalanus* sp. These parasites can interfere with the growth of fish as they consume nutrients obtained from food.

Of the 30 samples examined, 5 were infected with *Lecithocladium* sp. in the stomach, while none were found in the intestine. *Anisakis* sp. was detected in the intestine of 2 species, but not in the stomach. *Rhadinorhynchus* sp. was found in the intestine and stomach of 12 samples, while *Camallanus* sp. was only found in the intestine of 11 samples. The distribution of these parasites in the mackerel's digestive tract is shown in Table (3).

Table 3. Samples of the mackerel fish infected with parasitic worms based on the examined digestive tract

Number of samples examined (tails)	Genus	Infected samples in the intestinal organs (tails)	Infected samples in the gastric organs (tails)
30	*Lecithocladium* sp.	-	5
	Anisakis sp.	2	-
	Rhadinorhynchus sp.	12	2
	Camallanus sp.	11	-

Prevalence of parasitic worms

The prevalence of parasitic worms in the digestive tract of the mackerel fish that arrived at the Belawan Marine Fishing Port exhibited different values. *Lecthocladium* sp., *Anisakis* sp., and *Camallanus* sp. showed a prevalence of 16.66% in the stomach, 6.66% in the intestines, and 36.66% in the

intestines, respectively. Meanwhile, *Rhadinorhynchus* sp. had a prevalence of 40 and 6.66% in the intestines and stomach, respectively. Table (4) shows the prevalence of parasitic worms attacking the digestive tract of the mackerel under study.

Table 4. The prevalence of parasitic worms in the digestive tract of the mackerel

Number of samples examined	Number of infected samples	Genus	Prevalence (%)	
			Intestines	Stomach
30	5	*Lecithocladium* sp.	0	16.66
	2	*Anisakis* sp.	6.66	0
	14	*Rhadinorhynchus* sp.	40	6.66
	11	*Camallanus* sp.	36.66	0

DISCUSSION

Parasitic worms were found to attack the intestinal organs of fish more than gastric organs. This is because the stomach primarily functions as a food reservoir before digestion, while the intestines provide an environment suitable for the survival of parasites worms. This finding is consistent with the results of **Arifudin and Nurlita (2007)**, indicating that the intestine is a source of nutrition for parasitic worms, including blood, tissue cells, body fluids, and food juices, contained in the intestine. According to **Bauw *et al.* (2016)**, the high prevalence of infections in the intestines is due to the parasites utilizing organic matter remnants in the fish's body. **Hibur *et al.* (2016)** also supported this notion, suggesting that morphologically, the intestine provided a nutrient-rich environment with food waste for parasites to exploit.

Arizona *et al.* (2020) stated that *Rhadinorhynchus* sp. was commonly found in fish belonging to the Scombridae family, while *Camallanus* sp. was commonly found in the mackerel living in open water **(Hidayati *et al.*, 2016)**. The parasitic worm *Lecithocladium* sp. infects only the stomach, while *Anisakis* sp. and *Camallanus* sp. infect only the intestine. Meanwhile, *Rhadinorhynchus* sp. infects both the intestine and stomach.

The presence of parasitic worms in the digestive tract of fish can be attributed to the consumption of arthropods and other small fish that act as intermediate hosts and unsuitable aquatic environmental factors. **Hidayat *et al.* (2018)** stated that the mackerel fish is a carnivorous fish that fed on fish, crustaceans, and mollusks. Additionally, parasitic infections in fish are usually associated with unfavorable environmental factors **(Sarjito *et al.*, 2013; Syukron *et al.*, 2017)** since high temperature and salinity often weaken the immune system, rendering the fish more susceptible to stress and disease.

Lecithocladium sp. found in the abdominal organs is classified as 'frequent', indicating a commonly occurring infection in the abdominal organs. *Anisakis* sp. and

Rhadinorhynchus sp., have a higher prevalence and can attack the intestines and stomach
(Hardi, 2015; Linayati, 2018; Hakim *et al*., 2019; Paulo *et al*., 2019). They fall into the 'general' and occasional categories, as ordinary infections of the intestinal organs and occasional infections of the stomach, respectively. The parasitic worm *Camallanus* sp. in intestinal organs is categorized as 'common', denoting the frequency of occurrence. **Nofasari *et al*. (2019)** attributed the high prevalence to several factors including environmental factors. Fluctuations in water temperatures are believed to cause changes in environmental conditions in water catchment areas. This induces stress in fish, and results in decreased fish resistance and increased parasites prevalence. The parasitic worms that attack the intestinal digestive tract includes *Anisakis* sp., *Rhadinorhynchus* sp., and *Camallanus* sp. **(Komariah & Dama, 2020)**.

The most common parasites that attack the intestines of the mackerel are *Rhadinorhynchus* and *Camallanus* sp., while *Lecithocladium* sp. predominantly attacks the stomach. The susceptibility of fish to parasites infections depends on size. **Linayati (2018)** stated that young fish were more susceptible to disease, particularly parasites, due to weaker antibody responses compared to adult fish. The larger the size of the fish, the better its resistance. In addition, younger fish are usually more susceptible to stress due to environmental changes that can lead to decreased immune responses to disease-causing organisms **(Maulana *et al*., 2017)**. The number of parasites infecting fish is influenced by many factors, such as foraging location, area, and fish length in the waters, resulting in differences in the type of food infected with the parasites between the two size groups. This finding alignes with that of **Alvin *et al.* (2019)**, who suggested a decline in environmental quality directly correlated with the increased prevalence of fish diseases, such as parasites.

The discovery of parasites worms in the digestive tract of the mackerel in this study is suspected to be closely related to the potential of water pollution. This can be attributed to the ability of parasites to accumulate heavy metals in higher concentrations **(Eliyani, 2017)**. Therefore, proper management practices should be implemented when consuming fish to ensure that parasites are killed during cooking and do not enter the body when eaten. Parasites that enter the body may cause disease symptoms in the human digestive organs. According to **Rokhmani (2017)**, disease prevention can be achieved by thoroughly cooking fish meat for at least 5-10 minutes at 60°C or higher, as high temperatures will kill the parasites worms (larvae).

CONCLUSION

In conclusion, the types of parasites worms identified in the digestive tract of the mackerel (*S. commerson*) were *Lecithocladium* sp., *Anisakis* sp., *Rhadinorhynchus* sp., and *Camallanus* sp. *Rhadinorhynchus* sp. had the highest prevalence in the intestine, with smaller amounts in the stomach, while *Lecithocladium* sp. had the highest prevalence in the stomach.

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